

Gas Fired Door Heater  
Model B-22 and B-24  
Installation & Maintenance Instructions



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## I DESCRIPTION

The Berner Gas-Fired Door Heater is designed to instantly direct a stream of heated air toward a large door opening, when the door is opened in cold weather. It utilizes a ring type burner operating on natural gas. The propeller is a special Ductaxial solid aluminum casting, direct connected to an industrial duty, totally enclosed motor.

The burner is the product of many years of experience in the crop drying field with direct-fired burners.

Products of combustion, which are discharged directly into the main airstream, consist of carbon dioxide and water vapor. At maximum rated heat output the concentration of CO<sub>2</sub> is approximately 2000 PPM (parts per million) compared with a maximum allowable\* of 5000 PPM.

Although the water vapor of combustion is added, relative humidity is actually reduced, owing to the heat that is added to the air. At maximum rated heat output, and assuming 60° F. saturated entering air, the discharge air is less than 5% RH.

## I MOUNTING POSITIONS

(A) Burner: The standard unit may be installed at any angle between horizontal and vertical down airflow. The control cabinet is on the left-hand side, facing the airstream. The back panel of the cabinet must lie in a vertical plane; (i.e., the burner house cannot be rotated, thus rolling the cabinet toward the top or bottom of the burner house).

(B) Plumbing: The gas piping elbows up and into the burner house on the bottom centerline. During installation, by loosening the union just outside the heater, the piping train may be rotated to any desired direction, provided valves are properly oriented.

(See CAUTION)

## III INSTALLATION (MECHANICAL)

One Door Heater will handle up to approximately a 12' x 15' door opening. Larger opening require two or more heaters.

**CAUTION:** No door heater can substitute for a Tempered Intake Air Unit. If in-plant negative pressure exists because of exhaust ventilation, makeup air must be provided before a door heater can be expected to function properly. See your Berner representative.

The heater should be aimed at a spot on the floor about four or five feet inside, and midway across, the door. At the inlet end there should be no obstructions to the airflow closer than 20" - 24"; at the outlet end, of course, there should be nothing obstructing the airstream. Around the sides of the heater there should be no combustible material closer than three feet.

## IV. GAS PRESSURE REGULATOR

Gas supply pressure must be specified at the time of ordering, so that the proper regulator can be furnished to reduce line pressure to 6" - 8" W.C.

It is suggested that a 1/8" or 1/4" I.P.S. test connection be provided in the gas supply line upstream of the regulator to facilitate taking pressure readings at time of startup and adjustment of burner equipment.

Make sure that the regulator is installed in the line with the arrow on the body pointing in the direction of the flow of the fuel.

With the regulator properly installed in the line, the following procedure is suggested when ready to light off and adjust the burner.

(A) Remove the "top cap" of the regulator and check for shipping block or rod installed between spring and top cap. Remove, if found.

(B) Remove plug, in vent opening of diaphragm housing. (Connect vent to atmosphere, if required by plant or insurance regulations. See Suggestions for Regulator Venting).

The setting of the spring beneath the "top cap" on the regulator determines the outlet pressure. Screwing in on it increase the outlet pressure. Screwing out reduces the outlet pressure. The outlet pressure from the regulator will not necessarily be the same at full fire as under static conditions of no flow. Therefore, when adjusting gas pressure to very heat output, do so with the heater in operation. (See Maintenance.)

Although most regulator problems in the field have to do with insufficient pressure at the outlet (usually because of line losses), it is well to know what to do in case the regulator won't deliver a low enough pressure: Turning it upside down in the line will frequently do the trick.

## V. SUGGESTIONS FOR REGULATOR VENTING

(See also Safety Devices on vent valve)

One purpose of the vent connection is to provide a safe means of venting gas if the regulator diaphragm should fail. The vent also provides relief from the space above the diaphragm as it moves during regulation. A restriction in the vent line can result in poor regulator performance.

The vent line should normally be piped outside the building, with as short a run of pipe as possible. There should be a minimum number of bends, and the pipe should be as large as practical, using the vent hole size as a guide. When tubing is used (on the smaller regulators), care must be exercised to avoid sharp bends and the resultant reduction in area.

Grouping vent lines together into a common header is not normally recommended. If they must be grouped, the header

cross-sectional area should be at least equal to the sum of the individual vent areas.

The outside end of the vent line should either have a weather-proof vent cap or should be directed downward for weather protection. It should also be screened to prevent foreign material or insects from entering the line. Naturally, the end of the line should be located in an area where it is safe to release gas.

A high percentage of regulator problems is due to improper venting. Remember the space over the diaphragm must be able to breathe for proper regulation. If there is any regulation problem, disconnect the vent line at the regulator to see if proper venting is the solution. Then look for undersized lines, crimped tubing, clogged lines, back pressure caused by draft effect at end of vent or pressure effect from other regulators in a grouped system.

## VI. INSTALLATION (ELECTRICAL)

All internal electric wiring is factory installed. It is only necessary to connect main power leads to terminals L1 - L2 - L3 of the terminal strip inside the cabinet, and to wire between remote station, door switch, and heater.

The remote station may be installed at any location for convenience in switching the heater to "OFF" or "SUM" for warm weather.

The door limit switch must be installed on the door frame in such a way that it is tripped by the opening of the door. A switch having 2 poles, one normally open and one normally closed, is furnished, so that whichever pole is closed by the opening of the door, may be used to actuate the heater.

## VII. INSTALLATION (GAS PIPING)

(See Section Mounting Position Plumbing)

**CAUTION:** When making up gas piping, be sure all valves are in a horizontal portion of the gas line, with valve body properly positioned:

- (A) Main safety valve actuator may be in any position.
- (B) Pilot gas valve mounts in any position except with solenoid inverted (vertically down).
- (C) Secondary safety valve must have the solenoid upright, no more than 5° out of plumb, in a horizontal gas line.
- (D) Vent valve may be mounted in any position.
- (E) Regulator may be removed and reinstalled further upstream in the gas line, but no further than a few feet from the heater. Regulators may be installed in any position, except do not install a Maxitrol low pressure regulator in a vertical-up gas line.

A manual cock (not furnished) should be piped in ahead of the regulator. (See schematic piping on wiring diagram.)

## VIII. SAFETY DEVICES

(A) Gas Pressure Switches\*: Two U.L. listed gas pressure supervising switches are used, to shut off gas if pressure falls below or rises above the proper operating range. (See wiring diagram for proper setting.) Switches are preset at the factory during checkout.

Both switches have a vent connection for venting gas in case of a ruptured diaphragm. Connect vent to atmosphere per (Suggestions for Regulator Venting) above. The switches lock out if tripped, and must be manually reset. Thus, whenever gas is turned off manually, IPS must be reset.

(B) Safety Shut-Off Valve: This heater is equipped with a motor operated gas valve having closing spring that exerts a force in excess of 5 lbs. It is a fast-open, instant close valve meeting the requirements of FM, UL, AGA and CSA.

(C) Hi-Temperature Limit: The "Thermodisc" limit switch is located near the discharge end of the heater, mounted on the top outside of the duct. This is a U.L. approved manual-reset device.

(D) Airflow Switch: A UL-FM approved differential pressure switch in the control cabinet senses velocity plus static pressure of the airflow from the propeller. This air pressure closes the switch contact to power the gas system, thus assuring that the fan is on before the gas can ignite.

(E) Gas Control: The flame safeguard is Fireye UMM-1 F, which utilizes a flame scanner with an ultraviolet-sensitive gas discharge tube to monitor visually both pilot and main flame. At any time that it senses no flame, it de-energizes the automatic gas valve. (UL-FM approved)

With this unit, if main burner goes off after ignition, or if pilot fails to ignite at startup after an approximate 5-second trial-for-ignition, an external relay (CR) de-energizes the flame safeguard (CRE), and lights the small green "TURN RESET" pilot light. If this happens, turn the remote selector to "OFF/RESET" then back to "WIND" to reset CR for another start. Repeated failure to ignite may result in lockout of the CRE flame safeguard itself, causing small red "LOCKOUT" pilot to light. This button must then be reset at the control cabinet before another try-for-ignition can be made. If electric power to the control circuit fails for any reason, whether intentional or otherwise, and no matter how briefly, the flame safeguard gives a safe-start component check when power is restored. If a flame simulating component failure exists it will not proceed to the ignition cycle and will not energize the main gas valve.

The flame safeguard senses first the presence of pilot flame. Then, after the main automatic valve opens, the pilot is interrupted and main flame only is monitored. If main flame fails after pilot is interrupted there will be a 5 second trial for re-ignition per 2nd preceding paragraph.

(F) Fan Starter: Although not normally considered a safety device, the fan starter is wired so that its 13-14 interlock powers the control system. Thus the main fan must be energized before the gas system can be powered. This provides one more assurance, in addition to the Airflow Switch, that the fan is operating before heat comes on.

(G) Secondary Safety\*\* and Bleed Valves (or "Block & Vent Valves): A second main line gas valve is installed downstream of the primary safety valve. A vent line with an electrically operated normally-open valve takes off laterally between the two main line valves. This vent line must be piped to atmosphere outside the building, by the customer on installation (See Suggestions for Regulator)

## IX. OPERATION

GAS SUPPLY PRESSURE (in. w.g.)	MODEL B-22, 6500 CFM		
	1000'S BTU/HR	RISE (° F)	FINAL TEMP. (° F)*
5'	700	99	169
6'	765	109	179
7'	820	117	187
8'	7" MAX. RECOMMENDED		

GAS SUPPLY PRESSURE (in. w.g.)	MODEL B-24, 7900 CFM		
	1000'S BTU/HR	RISE (° F)	FINAL TEMP. (° F)*
5'	790	92	162
6'	865	101	171
7'	930	109	179
8'	990	116	186

\* Based on 70° F. inlet temperature.

(A) Gas Adjustment: Heat output is adjusted by varying the outlet pressure of the regulator (see Gas Pressure Regulator). A pressure gage may be attached to the piping at a leak-test connection. Table 1 shows performance at various inlet pressures.

(B) Pilot Adjustment: This heater is equipped with interrupted pilot; i.e., after main burner ignites, pilot is out off. Scanner then senses main flame only. Pilot flame was properly adjusted at the factory. Field adjustment is possible by removing the protective cap and using a screw-driver with a small bit.

## X. MAINTENANCE

(Note: See wiring diagram for part number and manufacturer of any control component. See manufacturer's instruction sheets for more information.)

(A) Fan Motor Bearings: Refer to green sheet on maintenance of direct-connected fans. Most fan motors have a 1/8" NPT pipe at each bearing, which may be removed for lubrication, in the event lube tubes were not factory-installed.

(B) Burner: Side plates and their air holes should be checked periodically, to be sure these parts are not fouled or plugged.

(C) Burner Adjustment: (See Operation).

(D) Fireeye: The UMM-IF utilizes solid state components. The only required maintenance is on its external components; i.e., the Flame Rod and the Ultra -Violet Scanner. See "Maintenance" in manufacturer's bulletin C-400.

(E) Scanner: Remove scanner occasionally, clean lens, and be sure that mounting pipe nipple is clear of insects and dirt.

(F) Spark Ignitor: Ignition takes place by means of a spark jumping from the ignitor to the side plate of the burner. The spark gap should be 1/8" to 3/16" (.12" -.19"), and located downstream of an air mixing hole, so that there is a gas-air mixture to be ignited. Check for carbon "bridge" between electrode and burner which may short out spark and prevent ignition.

## XI. TROUBLESHOOTING

First check for loose wiring connections. Then check the following for specific symptom:

(A) Fan Won't Start -

(1) Selector in "OFF" position.

(2) Check 3-phase line leads for power across all 3 phases, if one line is dead, check fuses or breaker in main disconnect.

(3) Check fuse on control circuit transformer.

(4) Try "SUM" setting. If fan runs, but won't run on "0", check 1T'HS outdoor thermostat (if used) for open R-B contact; check limit switch on door for open-contact.

# TROUBLESHOOTING

SYMPTOMS	CAUSE
FAN WON'T START	<ol style="list-style-type: none"> <li>1) Selector in "OFF" position</li> <li>2) Check 3-phase line leads for power across all 3 phases  (If one line is dead, check fuses or breaker in main disconnect)</li> <li>3) Check fuse on control circuit transformer</li> <li>4) Try "SUM" setting. If fan runs, but won't run on "WIN", check 1THS outdoor thermostat (if used) for open R-B contact; check limit switch on door for open contact.</li> <li>5) Check overload relay on fan starter. If tripped, reset. If relay continues to trip, check motor full load amps versus M starter's overload relay's setting (adjustment dial on the front of starter). See manufacturer's instruction sheet.</li> </ol>
FAN OPERATES, GAS PILOT WILL NOT IGNITE, GREEN "TURN RESET" DOES NOT LIGHT	<ol style="list-style-type: none"> <li>1) Selector in "SUM" position. Turn to "WIN"</li> <li>2) Check wire 6 to ground 115 V (defective selector switch or wiring to same)</li> <li>3) Check wire 7 to ground (bad 13-14 contact in starter)</li> <li>4) 9 to ground (bad R-W contact lo-gas switch)</li> <li>5) 10 to ground (bad R-B contact in hi-gas switch)</li> <li>6) 11 to ground (bad 4-5 contact in control relay)</li> <li>7) 12 to ground (bad C-NO contact in airflow switch; pressure setting too high, turn adjustment screw CCW until switch trips; clogged tubing in airstream)</li> <li>8) 13 to ground (reset Thermodisc, inside "handy-box")</li> <li>9) Check toggle switch in mounting base of Fireye (must be left in "ON" position)</li> </ol>
FAN OPERATES, GAS PILOT WILL NOT IGNITE, GREEN "TURN RESET" LIGHTS CONTINUOUSLY WHENEVER FAN RUNS	<ol style="list-style-type: none"> <li>1) Defective time delay TDR. (Pull from socket, turn RESET, and try again)</li> <li>2) (IRI type only) - One or both gas pressure switched tripped. Press reset lever. If low-pressure can't be reset, check for cause of inadequate pressure. Check supply pressure <u>ahead</u> of regulator, if pressure exceeds rating of regulator, it may pass no gas or fail to regulate.</li> </ol>
FAN OPERATES, GAS PILOT WILL NOT IGNITE, GREEN "LOCKOUT" LIGHTS CONTINUOUSLY WHENEVER FAN RUNS	<ol style="list-style-type: none"> <li>1) Press reset button on Fireye</li> <li>2) If Fireye won't reset, check for presence of continuous gas pilot flame  CAUTION - In this case turn off manual cock in pilot line <u>before</u> stopping fan. Then investigate cause of pilot valve 1V sticking open</li> <li>3) If Fireye can be reset, but on next try-for-ignition, "TURN RESET" lights, refer to next sections. If "LOCKOUT" lights refer to last symptom.</li> </ol>

# TROUBLESHOOTING

SYMPTOMS	CAUSE
<p>FAN OPERATES, LITTLE OR NO PILOT FLAME, AND "TURN RESET" LIGHTS AFTER 5 SECONDS</p>	<ol style="list-style-type: none"> <li>1) Check gas pilot manual cock; should be left in open position</li> <li>2) Check all gas lines for clogging and for purging of entrapped air</li> <li>3) Check for moisture and/or conducting dirt on Sparktrode; check electrode for carbon "bridge" to burner, which may short out ignition spark</li> <li>4) Check for adequate pilot flame. Adjust needle valve at burner if necessary.</li> </ol>
<p>FAN OPERATES, PILOT IGNITES NORMALLY, THEN GOES OUT AS "TURN RESET" LIGHTS</p>	<ol style="list-style-type: none"> <li>1) Check all manual cocks in main gas line; these should be left open in normal position</li> <li>2) Check scanner; remove and clean lens; check mounting pipe nipple for clogging insects, dirt or rust</li> <li>3) With selector in "WIN" but unit not operating (i.e. door switch open-contact with door closed), hold match or lighter flame in front of scanner. Flame relay in Fireye chassis should pull in with audible "click". If not, proceed to next step</li> </ol> <p style="margin-left: 40px;">CAUTION - Before proceeding to next steps, turn selector to "OFF", make the changes suggested, and then return the selector to "WIN". This is important, because in "WIN" position, the Fireye is energized and electrical shock could result</p> <ol style="list-style-type: none"> <li>4) Detach #20 and #21 leads from installed scanner, attach a known good scanner to terminals #20 and #21, and repeat previous step. If flame relay now pulls in, install new scanner. If not, re-install leads from original scanner and proceed to next step.</li> <li>5) Replace Fireye chassis, inside control cabinet, with a known good unit, and repeat step 3. If flame relay still does not pull in, have scanner and chassis checked by Fireye distributor or by Bemer.</li> </ol>
<p>FAN OPERATES, PILOT IGNITES NORMALLY, THEN GOES OUT AS "LOCKOUT" LIGHTS</p>	<ol style="list-style-type: none"> <li>1) With fan operating momentarily jumper circuit #7 to #8. This should result in control relay CR pulling in, lighting "TURN RESET" pilot and extinguishing "LOCKOUT". If so, insert new TDR relay (Amperite 115N05). If not proceed to step 2</li> <li>2) With fan operating, check for 115 volts across circuits #8 and #2 (at "coil" connections of CR control relay). If no voltage, jumper per step 1. If still no voltage backtrack through circuits 8, 7, 6 and 5 to determine where break in circuit exists. If 115 volts is measured but relay does not pull in, or if relay does pull in but "LOCKOUT" remains lit, replace CR relay</li> <li>3) After either steps 1 or 2 corrective action has been taken, continue with last two symptoms.</li> </ol>